

CLAIMS:

1. An offset measuring mechanism in a bonding apparatus that includes:

a position detection camera that detects the position of a part to be bonded on a bonding working plane,

a bonding tool that is disposed with an offset from said position detection camera, and

a moving means for moving said position detection camera and said bonding tool as an integral unit on a plane parallel to said bonding working plane,

wherein said offset measuring mechanism that measures said offset comprises:

an offset measuring camera which is disposed on an opposite side of said bonding working plane from said position detection camera and said bonding tool and which faces said bonding working plane;

an imaging position measuring means which uses said moving means to move said position detection camera into a measurement range of said offset measuring camera and determines a reference position of an imaging range in an imaging plane of said position detection camera based upon measurement of said imaging plane of said position detection camera by said offset measuring camera;

a tool position measuring means which uses said moving means to move said bonding tool into said measurement range of said offset measuring camera and measures a tool position of said bonding tool with said offset measuring camera; and

an offset calculating means which calculates said offset based upon a measured value of said determined reference position of said imaging range and a measured value of said tool position.

2. The offset measuring mechanism according to Claim 1, wherein

said position detection camera has a plurality of imaging elements disposed in two dimensions in directions of mutually perpendicular element disposition axes which are associated with mutually perpendicular imaging reference axes of said imaging plane; and

said reference position of said imaging range is a reference position of said two-dimensional disposition of said plurality of imaging elements.

3. An offset measuring mechanism in a bonding apparatus that includes:

- a position detection camera that detects the position of a part to be bonded on a bonding working plane,
- a bonding tool that is disposed with an offset from said position detection camera, and
- a moving means for moving said position detection camera and said bonding tool as an integral unit on a plane parallel to said bonding working plane,

wherein said offset measuring mechanism that measures said offset comprises:

- a measurement reference member provided inside said position detection camera, said measurement reference member being disposed in a reference member disposition position that is associated with a reference position of said imaging range within said imaging plane of said position detection camera and is in a different plane from said imaging plane of said position detection camera, and an image of said measurement reference member being projected toward said bonding working plane;
- an offset measuring camera which is disposed on an opposite side of said bonding working plane from said position detection camera and said bonding tool and which faces said bonding working plane;
- an imaging range measuring means which uses said moving means to move said position detection camera into a measurement range of said offset measuring camera and which determines a reference position of an imaging range of said position detection camera based upon measurement of said member disposition position of said measurement reference member by said offset measuring camera;
- a tool position measuring means which uses said moving means to move said bonding tool into said measurement range of said offset measuring camera and which measures a tool position of said bonding tool with said offset measuring camera; and
- an offset calculating means which calculates said offset based upon a measured value of said determined reference position of said imaging range and a measured value of said tool position.

4. The offset measuring mechanism according to any one of Claims 1 through 3, wherein an object plane of said position detection camera and an object plane of said offset measuring camera coincide.

5. The offset measuring mechanism according to any one of Claims 1 through 3, wherein said offset measuring camera has an object side telecentric optical system.

6. The offset measuring mechanism according to any one of Claims 1 through 3, further comprising an offset measuring camera magnification calculating means, wherein said offset measuring camera magnification calculating means:

uses said moving means to move said bonding tool into said measurement range of said offset measuring camera and to further move said bonding tool within said measurement range so as to measure an amount of movement of an image of said bonding tool on said imaging plane of said offset measuring camera corresponding to said amount of movement; and

calculates magnification of said offset measuring camera based upon an amount of movement of said bonding tool and an amount of movement of said image of said bonding tool.

7. The offset measuring mechanism according to Claim 2, further comprising a position detection camera magnification calculating means, wherein said position detection camera magnification calculating means:

uses said moving means to move said bonding tool into a measurement range of said offset measuring camera; and

calculates a magnification of said position detection camera based upon measurement of predetermined dimensions of said plurality of imaging elements by said offset measuring camera.

8. The offset measuring mechanism according to Claim 3, further comprising a position detection camera magnification calculating means, wherein position detection camera magnification calculating:

uses said moving means to move said bonding tool into a measurement range of said offset measuring camera; and

calculates a magnification of said position detection camera based upon measurement of predetermined dimensions of said measurement reference member by said offset measuring camera.

9. The offset measuring mechanism according to any one of Claims 1 through 3, further comprising an offset measuring camera inclination calculating means, wherein said offset measuring camera inclination calculating means:

uses said moving means to move said bonding tool into a measurement range of said offset measuring camera and to further move said bonding tool within said measurement range;

measures a movement direction of an image of said bonding tool on said imaging plane of said offset measuring camera corresponding to said movement relative to mutually perpendicular measurement reference axes on said imaging plane of said offset measuring camera; and

calculates a relative inclination between movement reference axes of said moving means and measurement reference axes of said offset measuring camera based upon a movement direction of said bonding tool relative to mutually perpendicular movement reference axes of said moving means and a movement direction of an image of said bonding tool.

10. The offset measuring mechanism according to Claim 2, further comprising a position detection camera inclination calculating means, wherein said position detection camera inclination calculating means:

uses said moving means to move said position detection camera into a measurement range of said offset measuring camera, and

calculates a relative inclination of imaging reference axes of said position detection camera and measurement reference axes of said offset measuring camera based upon measurement of inclination of said element disposition axes relative to mutually perpendicular measurement reference axes in said imaging plane of said offset measuring camera.

11. An offset measuring method in a bonding apparatus that includes:

a position detection camera that detects the position of a part to be bonded on a bonding working plane,

a bonding tool that is disposed with an offset from said position detection camera,

a moving means for moving said position detection camera and said bonding tool as an integral unit on a plane parallel to said bonding working plane, and

an offset measuring camera which is disposed on an opposite side of said bonding working plane from said position detection camera and said bonding tool and which faces said bonding working plane;

wherein said offset measuring method that measures said offset comprises:

an imaging position measurement step for moving, with a use of said moving means, said position detection camera into a measurement range of said offset measuring camera and measuring a reference position of an imaging range in an imaging plane of said position detection camera based upon observation of said imaging plane of said position detection camera by said offset measuring camera,

a tool position measurement step for moving, with a use of said moving means, said bonding tool into said measurement range of said offset measuring camera and measuring a tool position of said bonding tool by said offset measuring camera, and

an offset calculation step for calculating said offset based upon a measured value of said reference position of said imaging range and a measured value of said tool position.

12. An offset measuring method in a bonding apparatus that includes:

a position detection camera that detects the position of a part to be bonded on a bonding working plane,

a bonding tool that is disposed with an offset from said position detection camera,

a moving means for moving said position detection camera and said bonding tool as an integral unit on a plane parallel to said bonding working plane, and

a measurement reference member provided inside said position detection camera, said measurement reference member being disposed in a reference member disposition position that is associated with a reference position of said imaging range within said imaging plane of said position detection camera and that is in a different plane from said imaging plane of said position detection camera, and an image of said measurement reference member disposed in said reference member disposition position being projected toward said bonding working plane, and

an offset measuring camera which is disposed on an opposite side of said bonding working plane from said position detection camera and said bonding tool and which faces said bonding working plane;

wherein said offset measuring method that measures said offset comprises:

an imaging range measurement step for moving, with a use of said moving means, said position detection camera into a measurement range of said offset measuring camera and measuring said reference position of said imaging range of said position detection camera based upon an observation of said reference member disposition position said measurement reference member by said offset measuring camera,

a tool position measurement step for moving, with a use of said moving means, said bonding tool into said measurement range of said offset measuring camera and measuring a tool position of said bonding tool by said offset measuring camera, and

an offset calculation step for calculating said offset based upon a measured value of said reference position of said imaging range and a measured value of said tool position.